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Trends in drug use among drivers killed in U.S. traffic crashes, 1999-2010

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Abstract

Objective—Driving under the influence of drugs is a global traffic safety and public health concern. This trend analysis examines the changes in general drug usage other than alcohol, broad categories, and typical prescription and illegal drugs among drivers fatally injured in motor vehicle crashes from 1999-2010 in the U.S.

Methods—Data from the Fatality Analysis Reporting System were analyzed from 1999-2010. Drug prevalence rates and prevalence ratios (PR) were determined comparing rates in 2009-2010 to 1999-2000 using a random effects model. Changes in general drug usage, broad categories, and representative prescription and illegal drugs including, methadone, oxycodone, hydrocodone, barbiturates, benzodiazepines, and cocaine, were explored.

Results—Comparing 2009-2010 to 1999-2000, prevalence of drug usage increased 49% (PR=1.49; 95% confidence interval [CI] 1.42, 1.55). The largest increases in broad drug categories were narcotics (PR=2.73; 95% CI 2.41, 3.08), depressants (PR=2.01; 95% CI 1.80, 2.25), and cannabinoids (PR=1.99; 95% CI 1.84, 2.16). The PR was 6.37 (95% CI 5.07, 8.02) for hydrocodone/oxycodone, 4.29 (95% CI 2.88, 6.37) for methadone, and 2.27 (95% CI 2.00, 2.58) for benzodiazepines. Barbiturates declined in rate over the 12-year period (PR=0.53; 95% CI 0.37, 0.75). Cocaine use increased until 2005 then progressively declined, though the rate remained relatively unchanged (PR=0.94; 95% CI 0.84, 1.06).

Conclusions—While more drivers are being tested and found drug-positive, there is evidence that a shift from illegal to prescription drugs may be occurring among fatally injured drivers in the U.S. Driving under the influence of prescription drugs is a growing traffic concern.

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Keywords

Drugs; Accidents; Epidemiology; Trends

1. Introduction

Motor vehicle collision remains one of the leading causes of injury mortality in the U.S. (Rockett *et al.* 2012). Research suggests that driving under the influence of drugs other than alcohol is a growing public health (Walsh *et al.* 2004) and global traffic safety concern (Morland 2000, Movig *et al.* 2004). In the U.S., the prevalence of drug-involved driving was estimated to be 11%-14% in 2007 (Lacey *et al.* 2009).

Driving under the influence of either illegal drugs or prescription medications may lead to driver impairment and/or an increased risk of motor vehicle collision. In regards to illicit substances, there are inconsistencies in the research concerning stimulants, such as cocaine or amphetamines, and driver cognizance (Kelly *et al.* 2004). As for prescription medications, benzodiazepines have been linked to an increased risk of motor vehicle collision (Walsh *et al.* 2004). There is evidence that those taking prescription opioids, such as oxycodone or hydrocodone, may be at an increased risk of traffic crash (Orriols *et al.* 2009). Contrarily, for the opioid methadone, there is no increased risk of motor vehicle collision associated with long term usage (Ogden and Moskowitz 2004).

The specific drugs consumed by fatally injured drivers and changes in their use over time throughout the U.S., including the role of prescription medications, have been largely under studied. Findings from the 2007 U.S. National Roadside Survey indicated that the occurrence of prescription narcotics, particularly the opioids oxycodone, hydrocodone, and methadone, and depressants, such as benzodiazepines, were common among those that drive under the influence with a prevalence of 1.2%-3.3% and 2.4%-3.4%, respectively (Lacey *et al.* 2009). Findings from the 2007 National Roadside Survey also suggested that cannabinoids and cocaine were common among those that drive under the influence (Lacey *et al.* 2009). Even though cannabinoids were more prevalent than cocaine amongst drivers under the influence (Lacey *et al.* 2009), cannabis has been legalized for medicinal use in several states (Koepsell *et al.* 1994), making it not entirely illegal. Therefore, cocaine is likely more representative of illicit drug use amongst those who drive under the influence as it a controlled substance typically not available outside of a healthcare institution.

Because of the potential for impairment and the prevalence of substance use amongst drivers, there is a need to discern how drug use is trending for public health intervention. Therefore, the purpose of this study is a trend analysis to examine the changes in drug use among fatally injured drivers in motor vehicle crashes from 1999 to 2010 in the U.S. Particular interest is given to changes in general drug usage, broad categories of drugs, and representative prescription medications and illegal substances including depressants, specifically benzodiazepines and barbiturates, opioids, explicitly methadone, hydrocodone, and oxycodone, and cocaine.

2. Method

2.1 Data source

The data for this analysis were obtained from the Fatal Analysis Reporting System (FARS). FARS is a publically available database maintained by the National Highway Traffic Safety Administration (NHTSA) (National Highway Traffic Safety Administration 2012). States report motor vehicle crashes to the NHTSA when at least one person involved in the collision dies within thirty days of the incident (National Highway Traffic Safety Administration 2012). Using strict quality control procedures, trained NHTSA analysts extract data from the state reported files (National Highway Traffic Safety Administration 2012). Consequently, the FARS database contains detailed information relating to the crash, vehicles, and people involved (National Highway Traffic Safety Administration 2012). As part of the reporting process, up to three drug test results per individual involved in the traffic collision can be documented in addition to a blood alcohol concentration; drugs administered after the collision are excluded from drug test results (National Highway Traffic Safety Administration 2010, 2012). Drug tests administered to drivers can be accomplished via urine drug screens, blood, or combination (i.e. urine and blood tests) post-collision.

States differ in their consistency of drug testing. Not all fatally injured drivers are tested for drugs and alcohol and not all states consistently report their results. For example, in the FARS database from 1999 to 2010, the average drug testing percent of all states combined was approximately 48%. Over the 12-year time span, the average overall drug testing percent of individual states ranged from 1% (Maine) to 90% (Hawaii) (National Highway Traffic Safety Administration 2010, 2012).

2.1.1 Study population—Because of the differences in states' drug testing and consistency of reporting, there were data quality concerns. A comprehensive analysis was conducted on each state regarding overall drug testing percentage of fatally injured drivers, percent of their population testing positive for drugs, and the proportion of drug results listed as 'Other'. To be included in this analysis, a state must have a drug testing percent ≥ 50%. If the state's drug positive rate was high (i.e. >70%) or low (<5%) and/or proportion of drug results listed as 'Other' was high (>70%), the state was excluded as this may have indicated a data quality issue. The following states met the inclusion criteria: Arizona, California, Colorado, Georgia, Hawaii, Illinois, Kentucky, Maryland, Massachusetts, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, Washington, West Virginia, and Wyoming. Analyses were limited to all fatally injured drivers who died between January 1st, 1999 and December 31st, 2010 with a known drug test result from states meeting the inclusion criteria.

2.2 Statistical analysis

Descriptive characteristics of drivers testing positive for at least one drug were compared to drivers testing negative. Statistical significance of nominal data was determined thru Pearson's Chi Square Tests or Cochran-Mantel-Haenszel statistics. Cochran-Armitage Trend

tests with Modified Ridit scoring were performed on all ordinal data. Descriptive characteristics included age, gender, race, ethnicity, number of vehicles involved, a driving while intoxicated (DWI) conviction within the past 3 years, a previous crash within the past 3 years, blood alcohol concentration (BAC), the type of drug test administered, day, time, and year of the crash, how long the individual survived after the crash, and if they were a professional driver (i.e. held a commercial drivers license). With the exception of the variables indicating the type of drug test administered, professional driver status, and survival time, all variables were characterized similarly to previously published work (Brady and Li 2013). The type of drug test administered post-collision was categorized as a urine, blood, or combination test. Professional driver status was dichotomized. Survival time was dichotomized into death within one hour of collision or beyond.

BAC, measured in grams per deciliter (g/dl), was based on multiple imputed BAC levels determined by NHTSA (National Highway Traffic Safety Administration 2012). The NHTSA has previously published extensive literature on their multiple imputation methods of missing BAC for drivers involved in fatal traffic collisions (Rubin *et al.* 1998, Subramanian 2002). If BAC was missing for a driver, the NHTSA's validated model would impute 10 specific values of BAC across a range of possible values permitting the estimation of statistics including measures of central tendency and dispersion (Rubin *et al.* 1998, Subramanian 2002). Therefore, the overall estimate of BAC value was generated from 10 imputations, and PROC MIANALYZE in SAS was used to combine estimates.

Prevalence and prevalence ratios were calculated for drug presence among all fatally injured drivers with a known drug test result for each of the variables described using log binomial regression. The prevalence ratio was shown to quantify whether the demographic characteristic was associated with either an increased or decreased occurrence of a drug positive result compared to a referent sub-group. Age 25-34, male gender, white race, non-Hispanic ethnicity, possessing a non-commercial driver's license, blood alcohol concentration of 0.00, no previous crash or DWI, a day time collision, multiple vehicle involvement, survival time less than one hour, and a crash year of 1999 all served as referents.

Drug prevalence rates among drivers were assessed per year and by drug category or class. Any drug use was defined as testing positive for any one drug. Broad drug categories were grouped into drug classes including narcotics, depressants, stimulants, hallucinogens, cannabinoids, phencyclidine, or other. For specific, representative drugs, hydrocodone and oxycodone were grouped together separately from methadone as methadone is generally prescribed to treat opioid dependence (Mark *et al.* 2009). Benzodiazepines and barbiturates were used to assess depressants. Cocaine was used as a marker of illegal drug use because it is a controlled substance generally unattainable outside a healthcare institution.

Drug prevalence rates were determined by calculating the number of fatalities per drug category or class divided by the total number of drivers tested. These drug prevalence rates were presented graphically to depict trends over the 12-year period. The prevalence ratio was calculated by dividing the drug prevalence rates per drug category or class in 2009-2010 by the rates in 1999-2000. The purpose of the prevalence ratio was to quantify the overall

trend of drug prevalence at the beginning and end of the study period. All drug prevalence rates and prevalence ratios were calculated using log binomial regression model with random effects. This hierarchical regression model used state as the grouping variable to assess the random effects of state reporting and the fixed effects of the collision year. All statistical analyses were run using SAS/STAT® software, version 9.3 (SAS Institute Inc. 2010). The *a priori* level of statistical significance was 0.05 for all analyses.

2.2.1 Sensitivity analysis—Due to the differences in collision reporting amongst states, a sensitivity analysis was conducted. The sensitivity analysis investigated the effects of states' overall drug testing percentages on the results. All analyses previously described were re-run using data from states that routinely tested 80% or more of their fatality injured drivers; the following states met this criterion: California, Hawaii, New Hampshire, New Jersey, New Mexico, Rhode Island, Washington, and West Virginia. The results from the original analysis and the sensitivity analysis were compared to determine if a bias in reporting existed.

3. Results

The descriptive characteristics of the fatally injured drivers with complete toxicological profiles are presented by test result status in Table 1. Of the 95,654 drivers included in the analysis, 23,500 (24.6%) tested positive for at least one drug. With the exception of the day of the week and survival time post-collision, all demographic characteristics were statistically significant. Of the total drivers tested, 87.5% were between the ages of 21-64 years. Males were tested more often than females and tended to be of white, non-Hispanic race/ethnicity. Approximately 8% of the total drivers tested held commercial drivers' licenses. The vast majority of participants were administered a blood test (85.5%) to assess drug presence. Of the total drivers tested, approximately 62% had blood alcohol concentrations equal to 0 g/dl, compared to 33% of the total drivers tested had blood alcohol concentrations ≥ 0.08 g/dl. Over 95% of the drivers tested had not been previously convicted of DWI, while over 84% had not been involved in a recent collision. Of the total drivers tested, the day of the crash was not significant with almost equal percentages occurring during the week as opposed to the weekend. Of the total drivers tested, single-vehicle collisions were more prevalent than multiple-vehicle collisions (51.6% vs. 48.4%, respectively). Approximately 67.2% of the total drivers tested met their demise within 1 hour of crash, though this was not statistically significant (p=0.1519). Over the 12 year span, the total number of drivers tested steadily increased from 6,686 in 1999 to 7,032 in 2010 and this was significant (p= <0.0001). The results of the sensitivity analysis showed similar results (data not shown).

Table 2 presents the percentage of the population testing positive for drugs and the prevalence ratios for each demographic characteristic previously described. The prevalence ratio was shown to quantify whether the demographic characteristic/attribute was associated with either an increased or decreased occurrence of a drug positive result compared to the specified referent sub-group. Individuals aged <16, 55-64, and ≥65 years had a lower prevalence of drug positive results whereas individuals aged 21-24, 25-34, 35-44, and 45-54 years all had higher prevalence of drug positive results. Females tended to test positive for

drugs slightly lower than males (PR=0.90; 95% CI 0.87, 0.92). Asians had the lowest prevalence of positive drug tests (PR=0.59; 95% CI 0.54, 0.65) compared to all other races. Both Hispanic ethnicity (PR=0.84 95% CI 0.81, 0.88) and commercial drivers (PR=0.87; 95% CI 0.83, 0.90) had a lower prevalence of drug usage. Individuals with a BAC greater than 0.00 g/dl tended to test positive for drugs. Those with BAC concentrations between 0.01-0.07 g/dl had the highest prevalence of drug positive test results (PR=1.52; 95% CI 1.46, 1.59) followed by those with a BAC ≥0.08 g/dl (PR=1.30; 95% CI 1.27, 1.33). Individuals that had a previous DWI or crash within the past 3 years both tended to test positive for drugs. The presence of drugs was detected 28% higher in single vehicle collisions compared to multiple vehicle crashes (PR=1.28; 95% CI 1.24, 1.30). Interestingly, the prevalence of drug positive tests steadily increased from 1999-2010. While the number of drivers testing positive increased over this time span, the percentage testing positive for drugs increased from 18.1% in 1999 to 29.1% in 2010. The results of the sensitivity analysis showed similar results (data not shown).

The prevalence rates and ratios of drug involvement amongst these fatally injured drivers are presented in Table 3. From 1999-2000 to 2009-2010, the rates of drug involvement in fatally injured drivers in the U.S. dramatically shifted. Between these two time points, the number of fatally injured drivers whom tested positive for any drug use increased 49% (rate ratio, PR=1.49; 95% CI 1.42, 1.55). With the exception of hallucinogens, increases of drug prevalence rates were observed in virtually all broad categories of drugs from 1999-2000 to 2009-2010. The largest increases were seen in narcotics (PR=2.73; 95% CI 2.41, 3.08) depressants (PR=2.01; 95% CI 1.80, 2.25), and cannabinoids (PR=1.99; 95% CI 1.84, 2.16). As for specific drugs, prescription drug use radically increased amongst fatally injured drivers between 1999-2000 and 2009-2010. The greatest increases in rate were seen for prescription opioids. The rate of hydrocodone and oxycodone present in fatally injured drivers was more than 6 times higher in 2009-2010 compared to 1999-2000 (PR=6.37; 95% CI 5.07,8.02), while methadone detection was over 4 times higher in 2009-2010 (PR=4.29; 95% CI 2.88, 6.37). The rate of prescription benzodiazepines found in fatally injured drivers more than doubled in 2009-2010 compared to 1999-2000 (PR=2.27; 95% CI 2.00, 2.58). Barbiturates were the only class of prescription drugs to experience significant declines in rate (PR=0.53, 95% CI 0.37, 0.75). The rate of cocaine use in fatally injured drivers did not increase between 1999-2000 and 2009-2010 (PR=0.94, 95% CI 0.84, 1.06).

The results of the sensitivity analysis showed comparable results (not shown). The number of fatally injured drivers from these states whom tested positive for any drug use increased 54% (PR=1.54; 95% CI 1.43, 1.66). The largest increases were seen in cannabinoids (PR=2.51; 95% CI 2.18, 2.89), depressants (PR=2.27; 95% CI 1.86, 2.78), and narcotics (PR=2.14; 95% CI 1.76, 2.60). The rate of hydrocodone and oxycodone present in fatally injured drivers from these states was over 5 times higher in 2009-2010 compared to 1999-2000 (PR=5.34; 95% CI 3.63, 7.85), while methadone detection was over 3 times higher (PR=3.51; 95% CI 1.88, 6.55). Rates of prescription benzodiazepines more than doubled in drivers from these states (PR=2.46; 95% CI 1.94, 3.10). The rate of cocaine use in fatally injured drivers from these states did not increase between 1999-2000 and 2009-2010 (PR=0.89, 95% CI 0.72, 1.11).

Over the 12-year period, the patterns of drug involvement in fatally injured drivers also changed. From 1999-2010, the overall drug testing percent (Fig. 1) and number testing positive for any drug use steadily increased (Fig. 2). In general, narcotics, depressants, and cannabinoids steadily increased over this time span, while stimulants were on the rise until 2005, but progressively declined (Fig. 3). As for specific drugs, rates of prescription oxycodone/hydrocodone, methadone, and benzodiazepines have also been steadily increasing (Fig. 4). Prescription barbiturates declined over the 12-year period. Contrarily, the occurrence of cocaine among fatally injured drivers steadily increased from 1999 to 2005 and rapidly declined from 2006 to 2010. The results of the sensitivity analysis using states with over 80% testing percentage showed comparable results (data not shown).

4. Discussion

The principal finding of this study suggests that substance use is not only intensifying, but changing among those that drive under the influence of drugs in the U.S. With the exception of barbiturates, the occurrence of prescription drugs found in those involved in fatal traffic crashes has greatly increased from 1999 to 2010. The prevalence rates for narcotics, particularly hydrocodone, oxycodone, methadone, and depressants, such as benzodiazepines, have not only significantly risen, but are trending upwards. Contrarily, there appears to be a shift in illicit drug use. While drug prevalence rates for cannabinoids steadily increased from 1999 to 2010, this substance is becoming legalized for medicinal use in several states. Illegal drugs appear to be declining in fatal traffic crashes. The pervasiveness of cocaine in fatal vehicle crashes initially increased, but has been rapidly declining since 2006. Considering these observed trends, there is evidence that a shift from illegal to prescription drugs may be occurring in those involved in fatal traffic crashes.

These findings are consistent with the current literature. In the U.S., prescription opioid analgesic use has dramatically increased since the 1990's (Joranson *et al.* 2000, Paulozzi *et al.* 2006a). From 1997 to 2005, the retail sales of prescription methadone, oxycodone, and hydrocodone have risen 933%, 588%, and 198%, respectively (Manchikanti 2007). Similar trends have been seen in other countries. From 2000-2005, both prescription opioid and benzodiazepine consumption increased 1.5-10% (Ravera *et al.* 2009), whereas methadone (Ravera *et al.* 2009) and barbiturate use remained relatively stable in Europe (Nicholas *et al.* 2012).

The potential shift from illegal to prescription medication among those that drive under the influence may be evident in trends seen in emergency room departments and hospital admissions. Even though unintentional poisonings in the U.S. have dramatically increased, most of these incidences have been attributed to prescription drugs (Coben *et al.* 2010). From 1994-2002, emergency room cases involving narcotic analgesics increased 198% in comparison to cocaine, which only increased 39% (Paulozzi *et al.* 2006a). From 2004-2008, the number of emergency department visits due to the use of opioids and benzodiazepines increased 111% and 89%, respectively (Centers for Disease Control and Prevention 2010), which may be attributed to the fact that these two drugs are often used concomitantly (Jones *et al.* 2012). Similar trends have been observed in hospital admissions. Hospitalizations for poisonings due to prescription opioids, sedatives, and tranquilizers increased more than 65%

from 1999-2006 (Coben *et al.* 2010). Of these prescription medications, hospitalizations due to methadone and benzodiazepines increased 400% and 39%, respectively, compared to barbiturates, which decreased 41% (Coben *et al.* 2010). Death rates attributed to opioid analgesics was four times higher in 2008 compared to the rate in 1999 (Centers for Disease Control and Prevention 2011). Of these increases, deaths attributed to oxycodone and hydrocodone increased 57%, and methadone increased over 200% (Paulozzi *et al.* 2006b). Deaths from opioid analgesics surpassed overdose deaths attributed to cocaine (Centers for Disease Control and Prevention 2011).

Even though trends in prescription drug consumption and healthcare can be observed, a scarcity of information exists on the occurrence of driving under the influence of drugs in the U.S. According to the NHTSA, from 2005-2009, the presence of both prescription and illegal drugs in fatally injured drivers increased from 28% to 33% (National Highway Traffic Safety Administration 2010). A study conducted in Washington State showed that cocaine use increased 2% and benzodiazepine use increased 275% in fatally injured drivers (Schwilke *et al.* 2006). Even though illicit drug use prevailed over prescription substances in this analysis, the findings indicate that prescription medications are becoming more ubiquitous in drugged driving incidences (Schwilke *et al.* 2006). Another U.S. study indicated that polydrug use (i.e. the concurrent usage of two or more drugs) may also be problematic (Brady and Li 2013). The primary concern with multiple medication use is the interactive effects of the drugs which may impair the driver even more then if the substances were used separately. While epidemiologic data regarding polydrug use are scant, approximately 20% of drivers found under the influence of drugs tested positive for two or more substances (Brady and Li 2013). Combinations of alcohol with cannabis and/or stimulants, including cocaine and methamphetamine, were found most prevalent (Brady and Li 2013).

Despite the lack of U.S. data, studies from other countries may provide evidence of shifting trends in drugged driving. The frequency of drugged driving has steadily increased in countries such as Sweden, Finland, Norway, Switzerland, France, Scotland, and Australia (Drummer *et al.* 2003, Mura *et al.* 2006, Bernard *et al.* 2009, Jones *et al.* 2009, Officer 2009, Ojaniemi *et al.* 2009, Senna *et al.* 2010, Blencowe *et al.* 2011, Bogstrand *et al.* 2011). Even though increases in illicit drug use, particularly cocaine (Mura *et al.* 2006, Senna *et al.* 2010), have been noted, greater increases in prescription drugs have been seen (Drummer *et al.* 2003, Bernard *et al.* 2009, Officer 2009, Ojaniemi *et al.* 2009, Blencowe *et al.* 2011, Bogstrand *et al.* 2011). Although increases in opioid analgesics and methadone have been observed, the largest increases have been seen in benzodiazepine use while driving (Drummer *et al.* 2003, Bernard *et al.* 2009, Officer 2009, Ojaniemi *et al.* 2009, Blencowe *et al.* 2011, Bogstrand *et al.* 2011).

The shifting trends in drug use among those that drive under the influence may be partly explainable. Cocaine is still a widely-used recreational drug in the U.S., but its popularity appears to be waning compared to alcohol, tobacco, and cannabis (Degenhardt *et al.* 2008). Recent declines have been attributed to the discontinuation of use and/or demise of frequent users (Reuter 2006). Cocaine is not as popular with young adults as teens appear to be abusing prescription drugs (Friedman 2006). Cocaine's recent decline may be attributed to

changes in the price of the drug and more effective anti-drug policies (Costa Storti and De Grauwe 2009). Several societal and political changes may have contributed to the rise of prescription drugs among those that drive under the influence. Internet pharmacies have made obtaining prescription medications easier (Manchikanti 2007). In addition, numerous benzodiazepines and opioids came off patent protection from 2004-2008 enabling generic versions to be manufactured (Adis International 2002, Bailey *et al.* 2006, Srihari *et al.* 2009). Generic drugs are typically less expensive making them more accessible to patients (Srihari *et al.* 2009). Healthcare policy initiatives may have exacerbated this problem. National initiatives to address the under-treatment of pain have been linked to the large increases in opioid prescriptions (Manchikanti 2007, Pletcher *et al.* 2008). Methadone use among drugged drivers may not have risen as quickly as other drugs partly because it is heavily regulated (Mark *et al.* 2009). Declines in barbiturate use among those that drive under the influence may be attributed to the development of newer, less toxic medications (Doghramji 2006).

The findings and implications of this study show that driving under the influence of drugs is a major public health concern in the U.S. As indicated by the observed trends, this problem will likely amplify. Awareness campaigns are needed to show both the public and healthcare providers that driving under the influence of drugs, including common prescription medications, may be hazardous. The need for more enforcement is likely necessary.

The strengths of this study are the use of multi-state data over a 12-year time span. Data obtained from fatally injured drivers is more likely to be comprehensive with greater chances of reportable drug test results compared to those simply injured or cited in a traffic collision. The weaknesses of this study are the limitations of the FARS data. As previously mentioned, not all drivers killed in fatal crashes were tested for drugs. This issue was addressed in the sensitivity analysis. In addition, only a maximum of three drugs can be documented per person in FARS, which could potentially be a bias in cases of multiple-drug involvement. These findings do not attempt to prove that the presence of drugs found in the fatally injured drivers caused the traffic fatalities or that the drugs identified were misused.

5. Conclusion

Among drivers killed in U.S. traffic crashes, the prevalence of drug use is rising and a shift from illegal to prescription medications may be occurring. While illegal substances, such as cocaine, have been declining, increases in narcotics and depressants were observed. The changes in trend may be a result of recent societal and political movements. These findings indicate that driving under the influence of drugs, particularly prescription medications, is a growing public health and traffic safety concern in the U.S.

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HIGHLIGHTS

- Patterns of drug-involvement among drivers killed in traffic crashes are changing
- Drug-positive prevalence increased 49% from 1999-2000 to 2009-2010
- Prescription drug use by drivers in fatal traffic crashes has considerably risen
- The use of illegal drugs, such as cocaine, in fatal crashes has declined

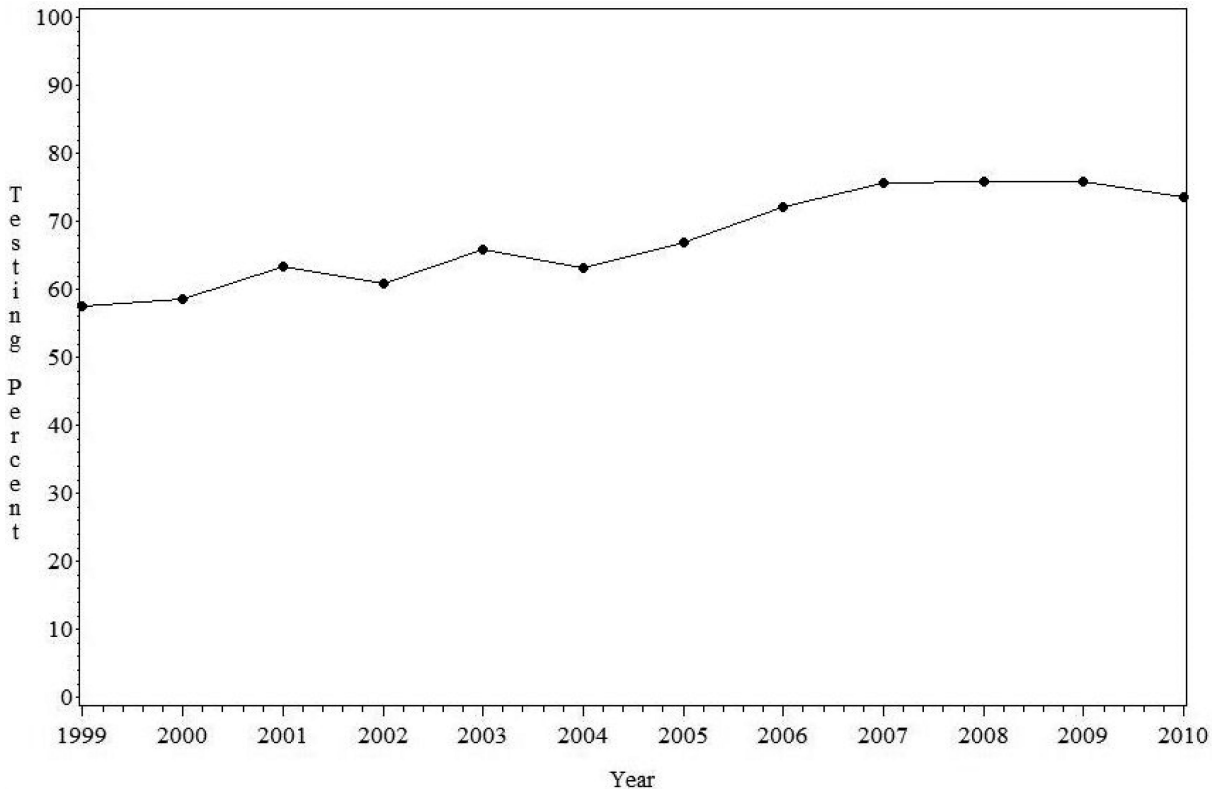

Figure 1.

Overall drug testing percentage of states that tested ≥ 50% of their fatally injured drivers, United States[a], 1999-2010

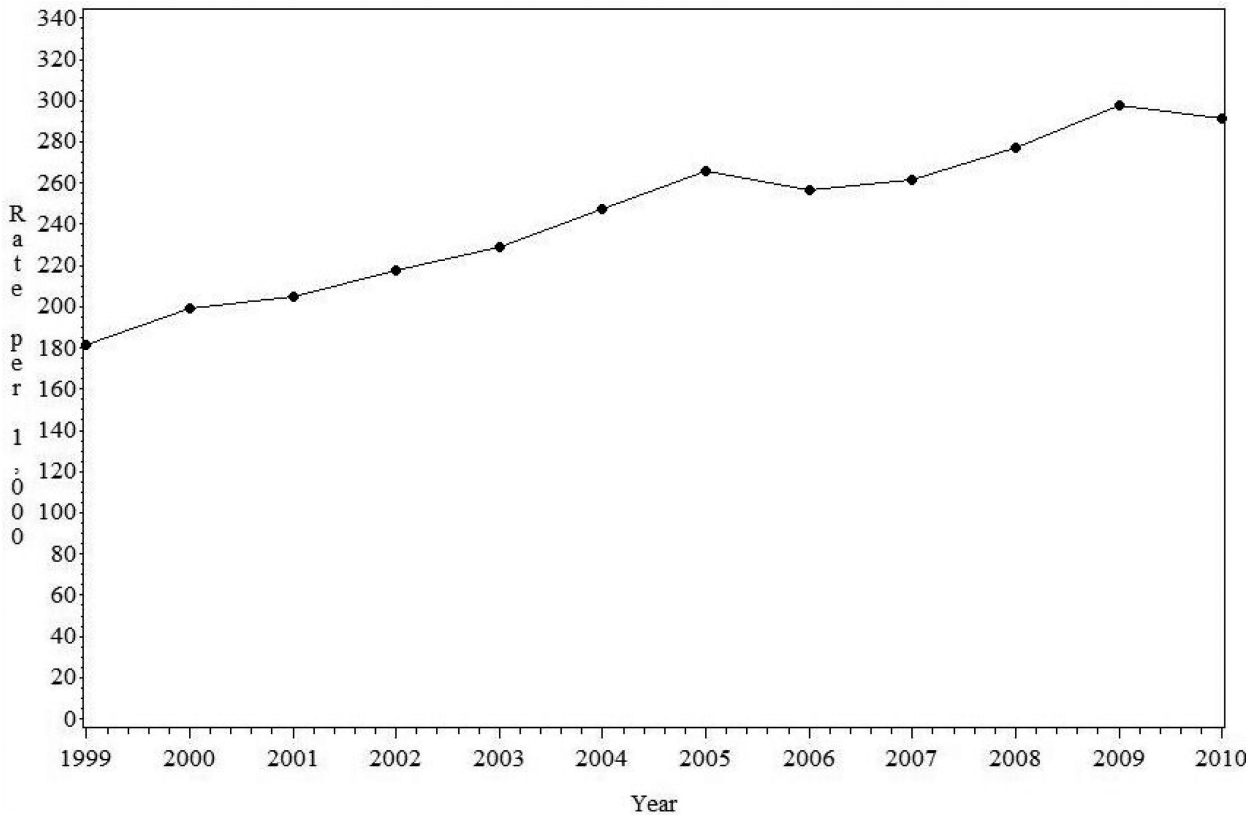

Figure 2.

Trends in any drug usage by year amongst all fatally injured drivers with a known drug test result, United States[a], 1999-2010

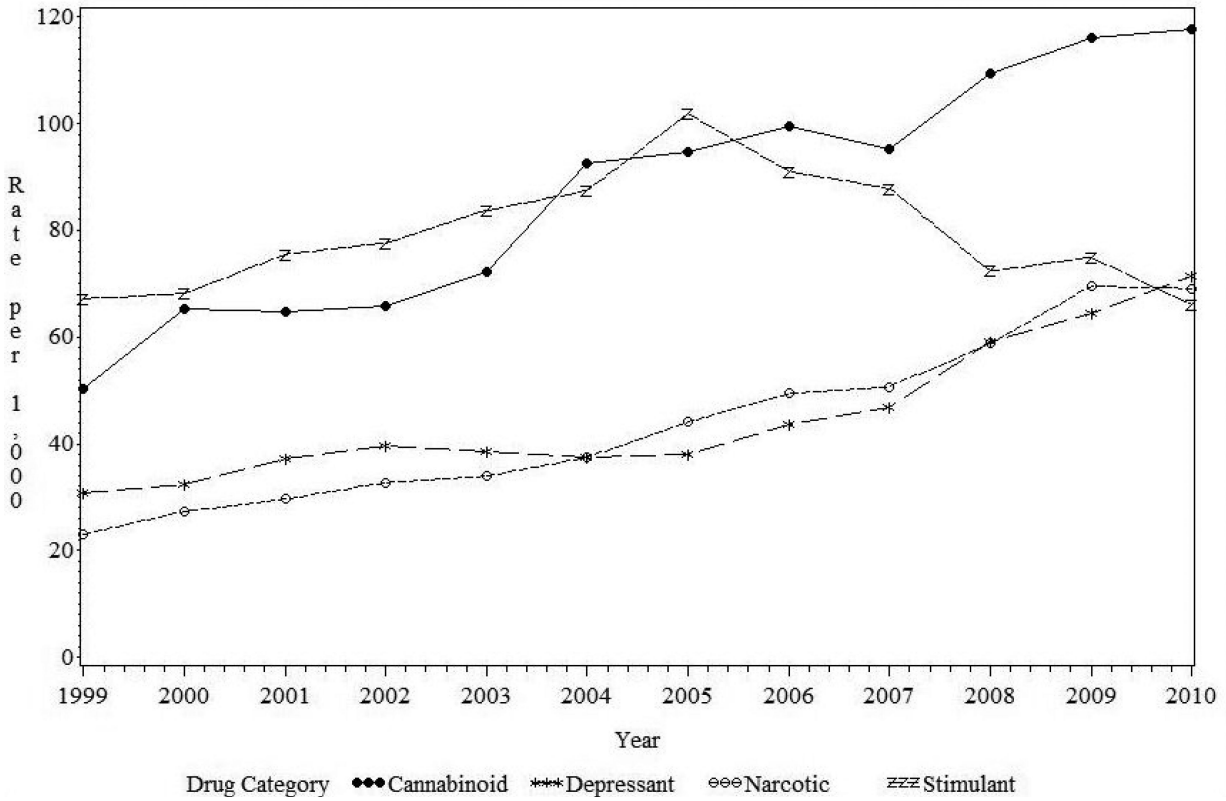

Figure 3.

Trends in broad drug usage by year amongst all fatally injured drivers with a known drug test result, United States[a], 1999-2010

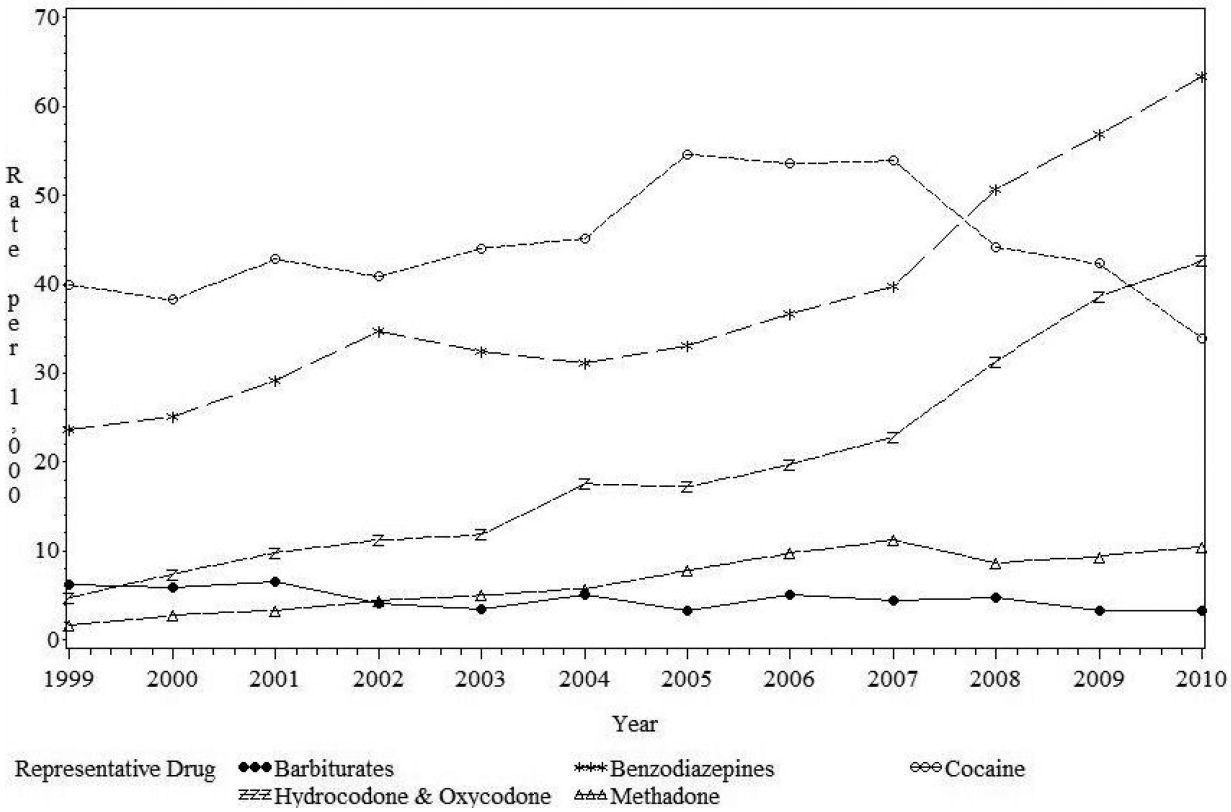

Figure 4.

Trends in representative prescription and illicit drug use by year amongst all fatally injured drivers with a known drug test result, United States[a], 1999-2010

TABLE 1

Characteristics of fatally injured drivers with known drug test results, United States, 1999-2010.

Characteristic	Drivers that tested positive for drugs (n=23,500)		Drivers that tested negative for drugs (n=72,154)		Total drivers tested (n=95,654)		
	No. of drivers	%	No. of drivers	%	No. of drivers	%	p-value
Age (in years)							
<16	49	0.2	338	0.5	387	0.4	<0.0001
16-20	2,781	11.8	9,221	12.8	12,002	12.6	
21-24	3,116	13.3	8,452	11.7	11,568	12.1	
25-34	5,339	22.7	13,768	19.1	19,107	20.0	
35-44	4,866	20.7	12,020	16.7	16,886	17.7	
45-54	3,984	17.0	10,755	14.9	14,739	15.4	
55-64	1,794	7.6	7,580	10.5	9,374	9.8	
≥65	1,558	6.6	9,982	13.8	11,540	12.1	
Unknown	13		38		51		
Gender							<0.0001
Female	4,999	21.3	17,100	23.7	22,099	23.1	
Male	18,500	78.7	55,047	76.3	73,547	76.9	
Unknown	1		7		8		
Race							<0.0001
White	18,143	87.0	52,707	84.7	70,850	85.3	
African American	1,969	9.4	6,376	10.2	8,345	10.0	
Asian	370	1.8	2,060	3.3	2,430	2.9	
Native American	265	1.3	749	1.2	1,014	1.2	
Other	101	0.5	356	0.6	457	0.6	
Unknown	2,652		9,906		12,558		
Ethnicity							<0.0001
Hispanic	2,372	11.6	8,536	14.1	10,908	13.5	
Non-Hispanic	18,056	88.4	52,061	85.9	70,117	86.5	
Unknown	3,072		11,557		14,629		
Professional driver							<0.0001
Yes	1,611	6.9	5,878	8.3	7,489	7.9	
No	21,589	93.1	65,221	91.7	86,810	92.1	
Unknown	300		1,055				
Type of Drug Test Administered							<0.0001
Urine	1,583	6.9	4,398	6.2	5,981	6.4	
Blood	18,236	79.3	61,964	87.5	80,200	85.5	
Urine and Blood	3,176	13.8	4,437	6.3	7,613	8.1	
Unknown	505		1,355		1,860		
Blood alcohol concentration (g/dl)							<0.0001
0	12,845	55.0	46,164	64.0	59,009	61.7	

Characteristic	Drivers that tested positive for drugs (n=23,500)		Drivers that tested negative for drugs (n=72,154)		Total drivers tested (n=95,654)		
	No. of drivers	%	No. of drivers	%	No. of drivers	%	p-value
0.01-0.07	1,840	8.0	3,708	5.0	5,548	5.8	
≥0.08	8,815	38.0	22,282	31.0	31,097	32.5	
DWI conviction within past 3 years[a]							<0.0001
No	21,605	93.5	68,013	96.2	89,618	95.5	
Yes	1,509	6.5	2,685	3.8	4,194	4.5	
Unknown	386		1,456		1,842		
Crash within past 3 years							<0.0001
No	17,499	81.3	54,676	85.0	72,175	84.1	
Yes	4,032	18.7	9,630	15.0	13,662	15.9	
Unknown	1969		7,848		9,817		
Day of crash							0.4910
Friday-Sunday	11,798	50.2	36,407	50.5	48,205	50.4	
Monday-Thursday	11,700	49.8	35,733	49.5	47,433	49.6	
Unknown	2		14		16		
Time of crash							<0.0001
Day (7:00am-6:59pm)	11,067	47.7	37,071	51.9	48,138	50.9	
Night (7:00pm-6:59am)	12,117	52.3	34,369	48.1	46,486	49.1	
Unknown	316		714		1,030		
Number of vehicles involved							<0.0001
1	13,532	57.6	35,833	49.7	49,365	51.6	
≥2	9,968	42.4	36,321	50.3	46,289	48.4	
Survival time after crash							0.1519
Within 1 hour	15,186	67.6	46,584	67.0	61,770	67.2	
Beyond 1 hour	7,295	32.5	22,909	33.0	30,204	32.8	
Unknown	1019		2661		3680		
Year of crash							<0.0001
1999	1,213	5.2	5,473	7.6	6,686	7.0	
2000	1,369	5.8	5,510	7.6	6,879	7.2	
2001	1,583	6.7	6,151	8.5	7,734	8.1	
2002	1,667	7.1	5,992	8.3	7,659	8.0	
2003	1,878	8.0	6,317	8.8	8,195	8.6	
2004	1,972	8.4	6,007	8.3	7,979	8.3	
2005	2,317	9.9	6,391	8.9	8,708	9.1	
2006	2,395	10.2	6,942	9.6	9,337	9.8	
2007	2,452	10.4	6,916	9.6	9,368	9.8	
2008	2,357	10.0	6,155	8.5	8,512	8.9	
2009	2,250	9.6	5,315	7.4	7,565	7.9	
2010	2,047	8.7	4,985	6.9	7,032	7.4	

[a]DWI=driving while intoxicated

TABLE 2

Prevalence and prevalence ratios for drug presence among fatally injured drivers with known drug test results, United 546 States, 1999-2010.

Characteristic	No. of drivers (n=95,654)	% of population positive for drugs	Prevalence ratio (95% CI)[a]
Age (in years)			
<16	387	12.7	0.45 (0.35, 0.59)
16-20	12,002	23.2	0.83 (0.80, 0.86)
21-24	11,568	26.9	0.96 (0.93, 1.00)
25-34	19,107	27.9	1.00 (Reference)
35-44	16,886	28.8	1.03 (1.00, 1.07)
45-54	14,739	27.0	0.97 (0.93, 1.00)
55-64	9,374	19.1	0.68 (0.65, 0.72)
≥65	11,540	13.5	0.48 (0.46, 0.51)
Gender			
Female	22,099	22.6	0.90 (0.87, 0.92)
Male	73,547	25.2	1.00 (Reference)
Race			
White	70,850	25.6	1.00 (Reference)
African American	8,345	23.6	0.92 (0.88, 0.96)
Asian	2,430	15.2	0.59 (0.54, 0.65)
Native American	1,014	26.1	1.02 (0.92, 1.13)
Other	457	22.1	0.86 (0.73, 1.03)
Ethnicity			
Hispanic	10,908	21.8	0.84 (0.81, 0.88)
Non-Hispanic	70,117	25.8	1.00 (Reference)
Professional driver			
Yes	7,489	21.5	0.87 (0.83, 0.90)
No	86,810	24.9	1.00 (Reference)
Blood alcohol concentration (g/dl)			
0	59,009	21.6	1.00 (Reference)
0.01-0.07	5,548	33.8	1.52 (1.46, 1.59)
≥0.08	31,097	28.3	1.31 (1.27, 1.33)
DWI conviction within past 3 years[b]			
No	89,618	24.1	1.00 (Reference)
Yes	4,194	36.0	1.49 (1.43, 1.56)
Crash within past 3 years			
No	72,175	24.3	1.00 (Reference)
Yes	13,662	29.5	1.22 (1.18, 1.25)
Day of crash			
Friday-Sunday	48,205	24.5	0.99 (0.97, 1.01)
Monday-Thursday	47,433	24.7	1.00 (Reference)
Time of crash			

Characteristic	No. of drivers (n=95,654)	% of population positive for drugs	Prevalence ratio (95% CI)[a]
Day (7:00am-6:59pm)	48,138	23.0	0.88 (0.86, 0.90)
Night (7:00pm-6:59am)	46,486	26.1	1.00 (Reference)
Number of vehicles involved			
1	49,365	27.4	1.28 (1.24, 1.30)
≥2	46,289	21.5	1.00 (Reference)
Survival time after crash			
Within 1 hour	61,770	24.6	1.00 (Reference)
Beyond 1 hour	30,204	24.2	0.98 (0.96, 1.01)
Year of crash			
1999	6,686	18.1	1.00 (Reference)
2000	6,879	19.9	1.10 (1.02, 1.18)
2001	7,734	20.5	1.13 (1.05, 1.21)
2002	7,659	21.8	1.20 (1.12, 1.28)
2003	8,195	22.9	1.26 (1.18, 1.35)
2004	7,979	24.7	1.36 (1.28, 1.45)
2005	8,708	26.6	1.47 (1.38, 1.56)
2006	9,337	25.7	1.41 (1.33, 1.50)

[a] CI=confidence interval

[b] DWI=driving while intoxicated

TABLE 3

Prevalence rates and ratios of drug involvement in fatally injured drivers with known drug test results, United States, 1999-2000, 2009-2010

Drugs	1999-2000		2009-2010		
	count	rate/1,000	count	rate/1,000	rate ratio[a,b] (95% CI)[c]
Any drug usage	2,582	190.3	4,297	294.4	1.49 (1.42, 1.55)
Broad drug categories					
Narcotics	342	25.2	1,012	69.3	2.73 (2.41, 3.08)
Depressants	428	31.6	990	67.8	2.01 (1.80, 2.25)
Stimulants	918	67.7	1,031	70.6	1.05 (0.96, 1.14)
Hallucinogens	28	2.1	25	1.7	0.88 (0.51, 1.52)
Cannabinoid	785	57.9	1,706	116.9	1.99 (1.84, 2.16)
Phencyclidine	10	0.7	29	2.0	1.86 (0.86, 4.01)
Others	643	47.4	808	55.4	1.08 (0.98, 1.20)
Representative drugs or classes					
Hydrocodone/Oxycodone	83	6.1	592	40.6	6.37 (5.07, 8.02)
Methadone	30	2.2	145	9.9	4.29 (2.88, 6.37)
Benzodiazepines	331	24.4	876	60.0	2.27 (2.00, 2.58)
Barbiturates	82	6.0	48	3.3	0.53 (0.37, 0.75)
Cocaine	530	39.1	558	38.2	0.94 (0.84, 1.06)

[a] Referent group: 1999-2000

[b] Rates and rate ratios were acquired via a random effects model that controlled for the random effects of each state and the fixed effects of collision year.

[c] CI=confidence interval